# NASA Activities

National
Aeronautics and
Space
Administration

**Vol. 8, No. 2**

**February 1977**

## Cover

**NASA's Supercraft for Shuttle Transport**—The Space Shuttle carrier aircraft in flight over the Rocky Mountains as testing begins at the Dryden Flight Research Center. The hardware added to a Boeing 747 aircraft is removable, including the horizontal stabilizer tip fins, and the forward and aft supports on which the Shuttle orbiter will rest. Approach and landing tests began early this year. Tests using strap-on liquid and solid-fuel tanks begin in late 1979 or in early 1980.

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NASA Activities is published monthly by the National Aeronautics and Space Administration for the information of the Agency's employees.

Contributions and recommendations are solicited from headquarters and field centers, and should be addressed to the Office of Public Affairs, Code FGC, Washington, D.C. 20546

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Annual subscription rate: $11.55 domestic; $14.45 foreign. Price per single copy: $1.00 domestic, $1.25 foreign.
Back issues not available.



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# Letter from Washington

Dear Colleagues

Fifteen years ago this month, when the Space Age was young, Lt. Colonel John Glenn rested in his quarters at Cape Canaveral. News photos showed his face impassive but the sag of his large shoulders indicated his frustration. The Friendship 7 mission had been scrubbed again.

Since late January 1962, Glenn had been waiting to blast off on the first American orbital flight. He had been suited up, had ridden the spindly elevator to the spacecraft module and, three times, something went wrong. Glenn had returned to his quarters and the days dragged on. The national commitment to place men on the Moon by the end of the decade had apparently stalled. The Soviet Union, first in space with Sputnik 1, an orbital trip already achieved, retained its supremacy in the exploration of humanity's new frontier.

Then, on Feb. 20, everything fell into place. John Glenn again entered his Mercury spacecraft, countdown proceeded, then ignition, a roar, and Astronaut Glenn was lifting off. He was to circle the Earth three times, flying parts of the last orbit manually with the autopilot malfunctioning. During reentry, the heat shield showed signs of buckling but it held. After splashdown, Glenn made the laconic comment, "Either way, I knew it would be over in a few seconds." The Mercury program was an historic success. The stage was set for Gemini and the crowning achievement of Apollo.

Today, a decade and a half later, NASA has recorded 118,077,569 statute miles of manned space flight. Man is at home in a new element. From Mercury to Gemini, Apollo to Skylab and Apollo Soyuz, the bonds of Earth have been cast off. The future is without limits.

This past year, we reached an unparalleled goal in deep space exploration with the twin Viking project; Mars is now familiar territory and we may repeat our visits in future years. Our earth resources and communications satellites are functioning far beyond expectation with their benefits to the people on Earth.

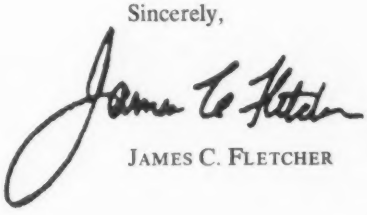
Test flights of the Space Shuttle begin this year, the initiation of a space transportation system. We will carry out countless experiments on the Shuttle orbiter, studying both Earth and space and their elements. And we will make major inroads into the feasibility of manufacturing in the space environment, enlarging the advantages already learned in the Skylab and Apollo-Soyuz missions.

In the near future we will use space in many ways to achieve better understanding of our basic Earth element and its potential and environment. Science and engineering will be afforded new dimensions in coping with a increasingly complex world. The vital search for new energy sources—solar, thermal and tidal—is going to mesh with other concerned agencies and interagency cooperation will come of national necessity.

In aeronautics, research and development as well as application have to assure the preeminence of U.S. civil aviation in the face of stiffening competition. The current personnel reviews are destined to assure that the right people are in the right positions, increasing NASA efficiency and dedication.

In the span of a teenage youngster's lifetime, we have soared from John Glenn's lonely wait in Florida to scientific marvels. But the potential for space surpasses all of the flights of fantasy down through the centuries.

Sincerely,



JAMES C. FLETCHER

# Monthly NASA Highlights

## Space Processing Rocket Launched

The third in a series of Space Processing Application Rockets was launched last Dec. 14, 1976, by a Black Brant VC sounding rocket from the Army's White Sands Missile Range in New Mexico. These low-cost rocket missions provide a means of obtaining space-processing scientific data in near-zero gravity.

The SPAR-III payload consisted of five space-processing experiments designed and assembled at NASA's Marshall Space Flight Center. During the coast phase of the suborbital ballistic trajectory, about five minutes of near weightlessness provided an opportunity to obtain space-processing scientific data.

All SPAR payloads are recovered by parachute for individual experiment analysis. The experiment processing apparatus is then reused on future missions. NASA's Goddard Space Flight Center provides the rocket system and directs launch and payload recovery operations.

## Perfect 1976 Launch Record

For the second time in its 19-year history, NASA was successful in all 16 of its launches in calendar year 1976. In 1972, NASA also had a perfect record, launching 18 satellites.

In keeping with the trend over the past several years, most of the 1976 launches were for outside organizations. Twelve were paid for by other government agencies, private corporations, and foreign countries; two were NASA missions; and two were cooperative scientific programs in which Germany and Canada supplied spacecraft that were launched by NASA in return for the opportunity of sharing the resulting science.

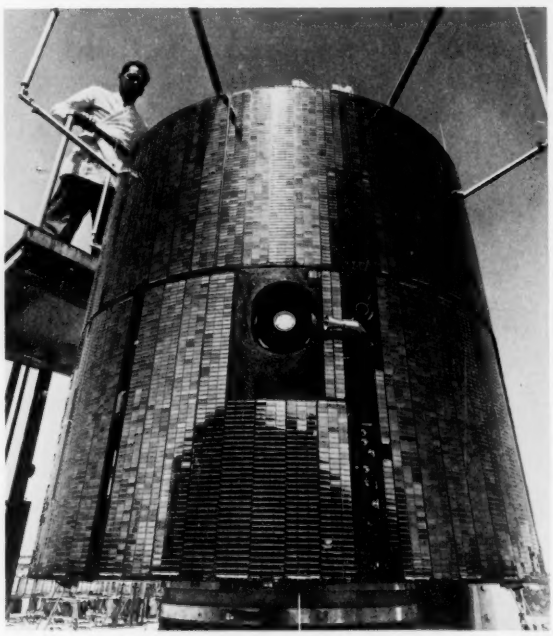
Fourteen of the 1976 launches were of direct benefit to humanity—11 were communication satellites, one was geodetic, one was a navigation spacecraft and one was for meteorology.

NASA authorities say that the perfect record in the bicentennial year resulted from teamwork on the part of the nationwide government-industry space teams. Participating NASA organizations are in Florida, Virginia, Maryland, Ohio and Washington, D.C. The major rocket contractors supplying the launch vehicles are in California, Colorado, and Texas. Eleven vehicles were launched from the Kennedy Space Center, four from Vandenberg Air Force Base, and one from the Wallops Flight Center.

## ATS-1 Begins 10th Year of Operation

On Dec. 7, 1966, NASA launched its Applications Technology Satellite. The satellite, designed to remain active for three years, carried instruments for combined research in communications, meteorology, aerospace engineering and science to demonstrate how technology might be applied in various areas so as to benefit humanity.

After 10 years, the ATS-1 still operates 18 hours a day. From its synchronous orbit over the equator south of Hawaii, ATS-1 views the western and mid-Pacific regions, including Alaska and the contiguous United States. This versatile satellite continues serving the medical emergency communications needs of remote Alaska peoples as well as relaying educational materials to university students throughout the Pacific area.



**Close Look at an ATS**—A techenician inspects the Applications Technology Satellite-2 before launch. The spacecraft's prime meteorological experiment, a spin scan cloud camera, can be seen in the center of the spacecraft. The entire exterior is covered with 22,000 solar cells. The camera produces global pictures of the Earth from stationary orbit of 22,300 miles.

## Three Air/Space Experts Named AIAA Fellows

Dr. George M. Low, former Deputy Administrator, came back to NASA as a guest at the recent unveiling of his portrait. It now hangs in NASA's administrative offices.

George M. Low, President, Rensselaer Polytechnic Institute; Smith J. DeFrance, retired director, NASA-Ames Research Center; and Luigi Broglio, Director, Centro Ricerche Aerospaziali and Professor of Aeronautical Engineering, University of Rome, Italy, have been elected by their peers, the Fellows of the American Institute of Aeronautics and Astronautics, to the status of Honorary Fellow. They were honored at the Institute's Fellow's Dinner held Jan. 12, 1977 at the Sheraton-Park Hotel in Washington, D.C.

Honorary Fellows are "persons of eminence in aeronautics and astronautics and shall be nominated by the Fellows residing in the United States." Each year, two American Honorary Fellows and one foreign Honorary Fellow are elected.

The citations for the new Honorary Fellows read as follows:

*George M. Low*—"For his engineering judgment, managerial skill, and outstanding leadership which have been directly responsible for the success of the nation's manned and unmanned space ventures."

*Smith J. DeFrance*—"For his leadership in directing and building NASA Ames Research Center to a position of eminence in aerospace research and development."

*Luigi Broglio*—"For his imaginative and innovative spirit in aeronautics and for the development of instrumentation and facilities for space research."

Dr. Low again was honored Jan. 14 at NASA Headquarters when his portrait was unveiled at a ceremony in the Administrator's office.

## Teleconferences via Satellite

Industry and government are continually seeking new methods to reduce the cost of business meetings, conferences and the exchange of information and data. NASA and the Westinghouse Electric Corp. have developed an experiment featuring teleconferences via satellite in an attempt to lessen the need for costly air travel, while still bringing participants face to face. The experiment will test the hypothesis that a large geographically dispersed organization can economically use a communications satellite coupled with low-cost Earth terminals to exchange information necessary to conduct business by video, audio and hardcopy means instead of transporting individuals over long distances.

The teleconferencing experiment is one of a number of experiments using the Communications Technology Satellite developed jointly by NASA and the Canadian Department of Communications. Other CTS experiments are designed to demonstrate the economic feasibility of using video relay satellites for adult and professional education, and determining how well satellites can broadcast public advice and information about health subjects. ■■■

## Vikings at Work Again

In mid-December, NASA's Viking spacecraft resumed activity on Mars after a month-long hiatus resulting from a partial blackout by the Sun of Viking-to-Earth communications.

The first of a series of radio commands to the spacecraft ordered the Viking orbiters to resume photographic and infrared coverage of the planet's surface. Soon afterward, commands were sent to the Viking landers, ordering them to continue gathering

Mars data at a modified rate until January and to begin playback of the data gathered during the blackout period on Dec. 20, including limited photographs of the area around the two landers, weather data, and information concerning inorganic chemistry, seismology and biology.

The resumption of activity marked the beginning of Viking's 18-month "extended mission," during which a variety of experiments will be conducted. These include:

- Additional photographs, temperature observations and water vapor measurements of the Martian surface and polar regions, some of these at twice the resolution of previous observations.
- Scooping up more soil samples for life-detection tests and inorganic chemical analysis.
- Monitoring for seismic events.
- Observing the planet's daily and seasonal weather changes.
- Taking close-up pictures of Mars' two tiny moons, Phobos and Deimos.
- Watching for evidence of the beginnings and development of planetwide dust storms.

Radio transmission from the Viking orbiters and landers was very noisy in mid-November because of solar conjunction, a phenomenon resulting from the presence of the Sun between Earth and Mars, and the consequent disruption of radio signals to and from the spacecraft. As Mars emerged from behind the Sun, communications again became reliable enough to transmit scientific data and command the spacecraft.

During the solar conjunction, an experiment was conducted to test Einstein's theory of general relativity, which predicts that the gravitational attraction of the Sun for a radio signal passing close to the Sun would cause a measurable delay in the arrival of that signal at Earth. The Viking radio science team, headed by Dr. William H. Michael of NASA's Langley Research Center, has measured the time delays. The Viking solar conjunction experiment (in which data were lost for a few days around Thanksgiving) provided a test of Einstein's theory at least an order of magnitude more advanced than previous experiments. Relativity data analysis work is led by Dr. Irwin Shapiro of the Massachusetts Institute of Technology.

The highlights of Viking activity during the recent past and the next few months, were listed by mission director G. Calvin Broome at the Jet Propulsion Laboratory, as:

- On Dec. 20, the orbit of Viking orbiter 2 was changed to lower the point of closest approach to Mars from about 1,500 kilometers (930 miles) to 800 km (480 mi.). The inclination of the orbit also was increased from 75 degrees to 80 degrees. This combination of changes provides for much more detailed viewing of the formation of the north polar hood and ice cap as winter approaches in the northern hemisphere. As summer approaches in the southern hemisphere, the scientists also will watch the recession of the south polar hood. These data will contribute greatly to our understanding of the atmosphere and surface of Mars.
- Viking orbiter 1 will continue to photograph several areas of the planet, as well as conduct infrared thermal mapping and atmospheric water detection measurements throughout the Martian day and night.
- Biology experiments on both landers will continue, with fresh soil scheduled for sampling in late January and February. Inorganic chemical analyses of fresh soils will continue, with emphasis on acquiring Martian pebbles for inorganic analysis, a feat not accomplished during earlier missions.
- Both Viking landers will continue monitoring the dunes around the spacecraft and the wind speed and direction on Mars, searching for evidence of the onset of a dust storm. Viking scientists are apprehensive over the possibility of a planetwide dust storm because next spring Mars will be nearing perihelion (closets approach to the Sun), a condition believed to play a role in triggering such storms. (At the time of the arrival of Mariner 9 at Mars in 1971, the entire planet was engulfed in the most masive dust storm in the history of Mars observations. The density of the dust severely limited observations from orbit for a period of several months after the arrival of the Mariner spacecraft.) Another such storm, even if considerably less severe, would make Viking observation from orbit difficult and could endanger the lander.
- In February, Viking orbiter-1 will be ordered to make a close approach to the Martian moon Phobos, taking pictures and making thermal measurements from as close as 50 km. (30 mi.). The photographs will show features on the moon as small as a few feet across.

**Langley Honors Retiring Congresman**—Rep. Thomas N. Downing (right) receives the Floyd L. Thompson award, for "sustained dedicated support of the Langley Research Center during 18 years as a Representative in the Congress of the United States." Langley director Donald P. Hearth made the presentation to Downing, who represented Virginia's First District, during the Congressman's last public appearance in his official capacity. The award honors the memory of the Langley director who served from 1960 to 1968.

## Sun's Magnetic Field May Reach Outer Limit of Solar System

The structure of the Sun's magnetic field appears to have been confirmed for the first time by the flight of Pioneer 11 into unexplored space high above the plane of the Earth's orbit. Measurements taken at 16 degrees above the Sun's equator—higher than ever before—show that the Sun's magnetic field probably reaches all the way to the planet Pluto, 2.5 billion kilometers away.

The significant discovery was announced in December by Dr. Edward J. Smith, a Pioneer II magnetometer experimenter at NASA's Jet Propulsion Laboratory. He said the finding is in strong accord with theoretical ideas of the Sun's field advanced by several scientists.

The unmanned Pioneer 11 left Earth more than three years ago and has moved through heretofore unexplored space almost a billion miles from Earth, a hundred million miles above Earth's orbital plane. The craft is on its first trip to Saturn.

According to Pioneer data, the Sun's magnetic envelope, roughly spherical and spanning the entire solar system, now appears to have a simple north-pole to south-pole structure. The field is split into northern and southern hemispheres at its magnetic equator by a warped electric current sheet.

"The magnetic field that originates on the Sun flows radially outward just like the quills on a porcupine," said Smith. The field, generated by electric currents in the Sun, is stretched far outward in every direction by the solar wind of charged particles that flows out constantly from the Sun.

Theoretical work on the problem was pioneered by Nobel Laureate Drs. Hannes Alfven of the University of California, San Diego, and Michael Schulz of the Aerospace Corp., El Sesundo, Calif. The model was further developed by Drs. Leif Svalgaard and John M. Wilcox of Stanford University.

The discovery is important for a better understanding of the mechanisms of the Sun, the Earth's source of light and energy. The finding also may provide important information on solar magnetic storms, which are channeled by the solar field and believed to affect Earth weather.

Workings of the Sun and its magnetic field have long appeared bizarre, and have been a subject of curiosity and speculation. The Sun's field reverses its direction every 11 years near the maximum development of the Sunspot cycle. During the reversal process, measurements have suggested that the general field is weak and disordered.

Because the Sun's equatorial regions rotate faster than the polar regions, the surface fields near the equator apparently wind around the Sun's middle like taffy, and magnetic fields there often run east-west.

Under the new model announced by Smith, in the current solar cycle the fields come primarily out of the Sun's northern hemisphere and are carried outward by the million-mile-an-hour solar wind. In most of the southern hemisphere, the field direction is reversed and comes back in toward the Sun. Near the magnetic equator, northern and southern fields are separated by a warped sheet of electric currents and these currents tend to circle the Sun in the inner solar system, but gradually turn and finally flow outward in the outer part of the solar system.

As the Sun rotates, the warped equatorial current sheet appears to move up and down in relation to the Earth's orbital plane. Since all spacecraft before Pioneer 11 traveled in the Earth's orbital plane, the current sheet passed through them each time it was warped below the spacecraft, and repassed them when warped upward again. Thus the spacecraft were in a magnetic field direction *away* from the Sun when above the current sheet, and in the magnetic field direction *toward* the Sun when below it. This

finding means that the earlier spacecraft saw reversals in magnetic field direction each time the current sheet passed through them, which led to a variety of interpretations.

In the warped current sheet model, as described by Svalgaard and Wilcox, the current sheet in interplanetary space has (at near sunspot minimum) a range in latitude of about 15 degrees on each side of the Sun's equator. When Pioneer 11 was 16 degrees away from the solar equator it was "too far north" (too high above the warped current sheet) for the sheet to encounter it. Hence the field reversals disappeared.

The random, small-scale magnetic fields in the Sun's mid-region have closed field lines that extend slightly into the corona but not beyond. These intense fields, says Smith, are often "all mixed up" because of the Sun's violent convection and uneven rotation. The north polar region, on the other hand, has a well-ordered field in just one direction, and the south in the opposite direction.

This large-scale magnetic configuration greatly eases the outflow of the solar wind and depletes the solar corona of charged particles. The formation of "coronal holes," is one result. They nearly always occur in the polar regions, and often extend downward, below the solar equator. The outflowing solar wind carries the solar magnetic field out until the solar wind ends when it encounters interstellar gas, perhaps near Pluto's orbit. There the outgoing north solar field may link up with the incoming south solar field to "close the magnetic loop."

"Perhaps the north and south field components never do link up," says Dr. Smith. "They could instead join with the interstellar magnetic field at the boundary. But the effect is the same with either alternative: you have a relatively simple field, something like the Earth's, but stretched far outward from the Sun by the solar wind."

**Parachute Recovery**—In preparatory exercises related to the launch of the Space Shuttle, a parachute retrieval system recently was tested in a basin at Port Canaveral, Fla., in about 12 meters (40 feet) of calm water. The crew, under the direction of the Kennedy center's Robert Everette, used an Air Force landing craft as a work platform. The Port Everglades Towing Co. piloted the craft, Federal Electric Corp. handled the instrumentation and Bendix personnel retrieved the chute. More tests will be conducted later in deeper and rougher water. The purpose of the testing is to establish procedures and develop hardware for retrieval of the Shuttle's solid rocket booster parachutes after they are jettisoned.

## Spacecraft as Census Takers?

NASA's Landsats 1 and 2 are currently undergoing a series of tests designed to evaluate their effectiveness as robot census takers in the 1980 U.S. census. The tests are part of a joint technology transfer project undertaken by the Bureau of the Census and NASA to assess the ability of the satellites to chart urban growth in 1980 and subsequently. (A complete U.S. census, by newly-enacted law, must be taken every five years.)

The Landsats can photograph the entire United States every nine days, cloud cover permitting. And, although Landsat images are not detailed enough for counting noses, people or houses, they can identify many geologic, agricultural and societal features, including residential patterns of growth.

Evaluation of the satellites' application to census requirements is being conducted at NASA's Goddard Space Flight Center and at the U.S. Bureau of the Census at Suitland, Md.

"Essentially, we want to see if Landsat can fit into the geographic operations of the Census Bureau and if it is cost-effective. We hope the satellites will provide us with an additional tool in meeting the increasing demands for urban growth information," said Jacob Silver, chief of the Census Bureau's geography division.

Research on the use of satellite data for census applications was initiated in early 1975. Since then, satellite imagery of Prince George's County, Md., and Austin, Tex., has been processed for the identification of major types of land-cover typical of the zone of transition from rural to urban landscape.

Austin proved to be an ideal test site because of the extensive and current field data available from a complete test census conducted there earlier this year. Discussing the Texas city, Jerrold W. Christenson, the Goddard project scientist said:

"We found that we could delineate urbanized boundaries from the rural countryside. The results of our investigation thus far indicate that Landsat information has a practical application to the problem of urban area delineation and to the detection of change."

Christenson is an environmental scientist in Goddard's Information Transfer Laboratory, established to facilitate the transfer of Landsat space technology to areas of potential application.

Before the 1980 national census takes place, Landsat census tests will be made on a regional basis in the Pacific northwest, and in the north-central and northeastern sections of the country, to be followed by verification tests in about 20 medium-sized urban acreas across the country. Tests already completed with the new Landsat census techniques indicate that the spacecraft has the potential of producing a significant manpower savings if used for national census-taking.

The first Landsat was launched July 23, 1972. It was followed by a second, identical spacecraft on Jan. 22, 1975. A third, improved Landsat is scheduled for launch in 1977.

The Landsat spacecraft are part of a major research program conducted by NASA to demonstrate the feasibility of using remote sensing from space for the management of Earth resources.

## Facility to Test Solar Heating and Cooling Opens in Alabama

A new solar heating and cooling test facility began operation in December as an integral part of a nationwide development and demonstration program headed by the Energy Research and Development Administration. Located on 20 acres at the NASA Marshall Space Flight Center, the facility will be used to evaluate solar systems, subsystems and selected components. Tests will determine operational efficiency and suitability for solar heating, cooling and hot water systems in residential and commercial buildings.

Following the test period, those systems meeting established criteria for economical and practical operation, maintenance and performance will be installed in residential and commercial buildings at selected operational sites through the country.

A part of the national effort to intensify development and marketing of this alternate source of energy, most of the systems to be tested at the site will be commercially built by a large number of manufacturers, including small and large businesses. Experimental systems provided by NASA and ERDA also will be tested.

The solar heating and cooling test facility can accommodate 511 square meters (5,500 square feet) of solar heat collectors at one time. Air-conditioning units up to 10 tons and heating systems up to 500,000 BTUs can be tested at the facility. Both air and liquid units will be investigated. Two large but easily accessible racks, simulating building roofs, will be used for testing "live" or working systems. A third rack will be used for passive testing to determine how well solar collectors stand up to weather conditions.

The new facility also contains a "test bed" for evaluating efficiency of tanks that store heat collected by the solar systems for use when there is no sunlight.

A central computerized data-collecting system will collect and store information on the effectiveness of the various heating and cooling units. This central facility also will collect data from the Marshall center's "solar house," which has been in operation for about three years, and from a solar simulator located in a nearby laboratory building.

The solar test facility was constructed in an area formerly used by the Marshall center as a test facility in the Saturn program. Data acquisition equipment used in that program is now being used in the new facility. The new construction was accomplished under a $647,243 contract.

The Marshall center is managing solar heating and cooling development, commercial demonstration and data acquisition programs in support of ERDA's nationwide demonstration program. The far-reaching program is designed to develop cost-competitive, reliable solar heating and cooling systems and subsystems leading to mass production and marketing by industry.

**Reversing a Trend**—NASA's Administrator Dr. James C. Fletcher, for a change is not the giver but the recipient of a "Distinguished Impresario Award" presented by the Kennedy Space Center's director Lee R. Scherer during the 3rd Century America award ceremony. Fletcher was cited: "for outstanding showmanship, fiscal understanding and management support in leading the U.S. Bicentennial Exposition on Science and Technology. His flair for show biz, knowledge of space spectaculars and ability to communicate scientific marvels to the public contributed significantly to the unexpected and precedent-shattering success of 3rd Century America." Earlier Fletcher had presented awards to KSC employees, employee groups and support organizations for helping to make the Bicentennial event a success.

## NASA Personnel Changes

Dr. James J. Kramer recently was appointed Associate Administrator of the Office of Aeronautics and Space Technology, replacing Robert E. Smylie, who assumed the position of deputy director of the Goddard Space Flight Center.

In his new post, Kramer is responsible for directing NASA research and technology programs to meet the nation's future requirements in aeronautics and space technology. He came to NASA headquarters from the Lewis Research Center in 1971. His former position was deputy Associate Administrator of the OAST.

Smylie has been acting Associate Administrator of OAST since July 1976.

In a related action, Paul F. Holloway was temporarily appointed acting deputy Associate Administrator for OAST, on assignment from the Langley center, where he is director for space programs. He has been with NASA since 1960.

## Lava May Be Answer to Martian Channels

Thin lava, not water, may have caused the large channels on Mars, according to Ernest Schonfeld, a scientist at the Johnson Space Center. In a paper presented at the December meeting of the American Geophysical Union held at San Francisco, he said that the Martian channels could have been created by a thin, runny, turbulent lava rather than the torrents of water cited by other scientists.

Schonfeld, a lunar scientist working at JSC's division of lunar and planetary sciences, says that the lava hypothesis offers an easier explanation than claims that water caused the large channels seen on Mars. The abundant large channels are one of the most puzzling landforms on Mar. Previous interpretations of Mariner and Viking mission photographs have suggested that the channels are remnants of old rivers or floods.

So far scientists have not been able to locate the thick sediment deposits that should be present if the channels were caused by water erosion. Viking-1 landed near the mouth of a large channel where thick sediment deposits would have been expected, but the rocks at the site appear to be volcanic.

In Schonfeld's view, thin, low-viscosity basaltic liquid may have melted beneath the planet's surface and flowed freely to erode surface channels. The amparen coincidence of the age of the volcanic activity and the Martian channel erosion seems to support that idea.

## Satellite Pictures Give Clues to Deserts and Droughts

An Israeli Landsat investigator has outlined a mechanism that may explain the reasons for deserts and cyclical droughts in some parts of the would.

Dr. Joseph Otterman, the Landsat investigator at Isreael's Tel Aviv University, has used Landsat and other spacecraft data, ground and aircraft reflectance, and temperature measurements in a study which states that the highly reflective soils of the Sinai, denuded because of overgrazing by domestic animals, are cooler under Sun illumination than the controlled grazing lands of the neighboring Negev.

The Negev, virtually undisturbed by grazing animals, has a more stable soil condition, more vegetation and more dark plant debris. Because of such factors, the Negev absorbs more of the Sun's radiation, causing a mass of heated air, or "heat mountain," which rises to form clouds and precipitation. The Sinai, with no such heat mountain, has much less rainfall.

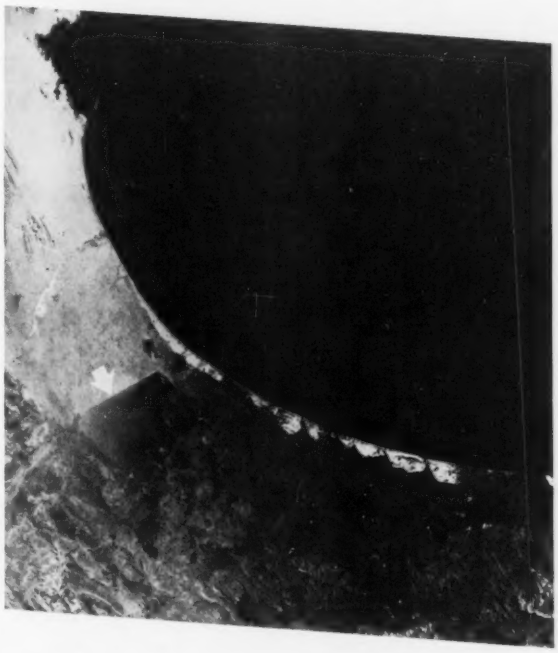
Dr. Otterman says his hypothesis may explain the formation of deserts along North Africa's Mediterranean coast and also patterns of cyclical drought. He says that if animals disappear from a region because of drought, the vegetation recovers. The ground reflectivity then decreases, surface temperatures increase and rains return to normal. A gradual population increase occurs, domestic animals eventually overgraze, and the cycle repeats itself.

"As a gross oversimplification, it can be postulated that a population explosion in grazing herds during the 'seven fat years' is the cause of the 'seven lean years,' " Otterman says.

Interviewed at NASA's Goddard Space Flight Center, home base for the Landsat project, Otterman —who was a 1974-75 research associate of the National Academy of Sciences, at Goddard—suggested that this mechanism might be studied in other parts of the world.

One of the Landsat photos of the area studied by Otterman clearly shows the denuded, high albedo (reflectivity) regions of the Sinai and Gaza Strip in sharp contrast to the darker western Negev. The line between the light and dark area coincides with the 1948-49 armistice line between Israel and Egypt, where a fence was built about five years ago.

A precision radiation thermometer flown over the Sinai-Negev border in August 1973 showed that surface radiation temperatures were about 45 degrees C. (113 degrees F.) on the Negev side and about 40 degrees C. (104 degrees F.) on the Sinai side. In February 1974, measurements taken with the instrument hand-held at ground level averaged about 33.5 degrees C. (92.3 degrees F.) on the dark side and about 30 degrees C. (92.3 degrees F.) on the bright side. Weather satellite thermal imagery from NOAA-2 also shows the Negev warmer than the Sinai. More precise quantitative assessments are expected when a third Landsat goes into orbit. It will carry more sophisticated heat-measuring instruments.



**Space Photos Define Contrasting Lands**—A Landsat view of the Sinai and the Negev deserts (at arrow and line) shows the decided difference between the relatively barren, dry Sinai-Gaza region (the light-colored section running above the arrow) and the more fertile, wetter Negev (below the arrow and at right of picture). The black mass in upper half of photo is part of the Mediterranean Sea.

## U.S. Scientists Study Soviet Moon Sample

Several grams of Moon soil collected last August by an unmanned Soviet spacecraft recently were transferred to NASA for analysis by American scientists, following a visit to Moscow last December by a three-member U.S. scientific delegation. In Moscow the scientists—Dr. Michael Duke, curator of lunar samples at the Johnson center; Prof. Gerald J. Wasserburg of the California Institute of Technology; and Dr. Charles Simonds of the Lunar Science Institute in Houston—examined the Moon soil brought to Earth by the Luna 24 spacecraft. They carried the sample back to the United States, delivering it to the Johnson Space Center.

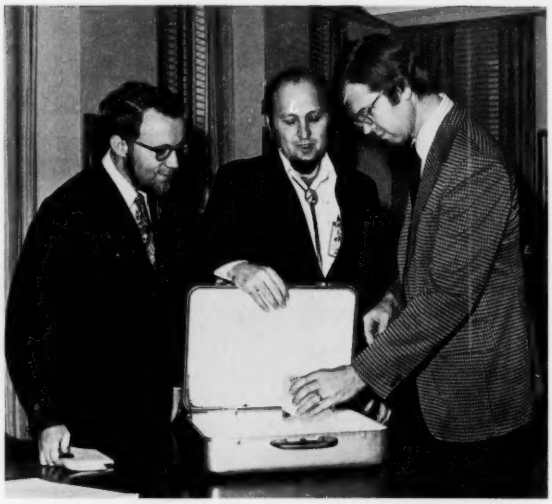
The Luna 24 material, which is two meters (six feet) long, came from a region of the Moon called Mare Crisium (Sea of Crises), and is the third Russian sample obtained by American scientists in exchange for material collected by Apollo astronauts from other places on the Moon. (Mare Crisium is visible to the unaided eye as a small dark spot on the upper right-hand edge of the Moon.)

The arrival of the Moon soil at NASA's lunar sample curatorial facility in Houston generated excitement among the several hundred scientists involved in an active program of lunar sample research.

"The Luna 24 sample is unique in two ways," said Dr. Noel Hinners, NASA Associate Administrator for Space Science. "First, it comes from a region of the Moon from which we have never obtained samples. Even more important is the fact that Luna 24 obtained a complete core down to a depth of two meters (about six feet) so we have a new slice to add to the three deep cores collected by the Apollo program."

The historical record contained in the Luna 24 core may go back several hundred million years. From studies of the larger, deeper (3 m. or about 10 ft.) cores of lunar soil returned by the Apollo 15, 16 and 17 missions, scientists expect that the Luna 24 core also will contain many different soil layers, each one representing the excavation of a small impact crater somewhere on the Moon. Analyses of the Apollo cores have revealed that some of the layers were deposited perhaps a billion years ago, and that each layer preserves traces of exposure to the Sun and cosmic rays during the Moon's past. The Luna 24 core makes it possible to extend this lunar history into a once-unknown part of the Moon.

Study of the Luna 24 sample will test the belief that Mare Crisium is covered by flows of dark-colored lava that poured over the Moon more than 3 billion years ago. The sample also will provide essential geological and chemical information to add to the data accumulated from samples collected by the six manned Apollo landings and two unmanned Luna landings.



**A Piece of the Moon from Russia**—Dr. Noel W. Hinners, NASA's Associate Administrator for Space Sciences, receives samples of lunar soil collected by the unmanned Soviet spacecraft, Luna-24. Drs. Michael S. Duke (center) and Bevan M. French look on. Duke, NASA's curator of lunar samples, was one of three scientists who visited Moscow to collect the sample; French is NASA's program chief for extraterrestrial materials research. The sample will be kept in Houston. American and Russian scientists regularly exchange Moon samples for study purposes.

An important consideration is that the sample may contain particles of the blanket of material thrown out of the huge crater Giordano Bruno, about 1,200 kilometers (745 miles) away, according to Dr. Duke. Such particles would be significant inasmuch as the Giordano Bruno crater is on the Moon's far side in an area extensively mapped from orbit but never actually sampled. The sample, therefore, could contain the first material ever returned that has a direct relation to a feature on the far side of the Moon.

The Luna 24 core also may preserve a potentially exciting record of the past history of the Sun. The soil, formed by meteorite bombardment, has been exposed for millions of years to all the solar and cosmic radiation that strikes the surface of the airless Moon. Trapped in the soil fragments are

actual atomic particles blasted out of the Sun millions of years ago. Comparisons of the Luna 24 core with similar cores returned by Apollo missions may provide new information about past solar behavior.

The Luna 24 samples also will provide a test of predictions made on Earth on the basis of telescopic observations of unexplored regions of the Moon. Scientists who have made spectral studies of the light reflected by lunar samples predict that the Luna 24 material will be a basalt lava with a low titanium content, much like the lavas returned by the Apollo 12 and Luna 16 missions. If these predictions are correct, scientists can obtain better chemical analyses of the moon from telescopic observations or from instruments in orbit around the Moon.

The small size of the sample is not a problem. "The Apollo program helped develop many methods for extracting a lot of information from small samples," said Dr. Bevan French, chief of NASA's extraterrestrial materials research program. "Using available methods, we can produce hundreds of chemical analyses from a single tiny crystal or determine the age of a rock fragment smaller than an aspirin tablet." Many of the recently perfected techniques to which he referred are now being routinely applied in studies that have resulted in the acquisition of exciting new information from meteorites and terrestrial deep-sea basalt samples, Dr. French said.

The Luna 24 spacecraft was launched from the Soviet Union on Aug. 9 and landed on Mare Crisium on Aug. 18. The robot spacecraft sent a thin, flexible hollow drill about six feet into the ground to obtain a complete section of the lunar soil layers. The Luna 24 spacecraft blasted off the Moon on Aug. 19, and delivered the sample chamber safely in western Siberia on Aug. 22. The core previously was studied at the Moscow Vernadsky Institute of Geochemistry and Analystical Chemistry, the Soviet Union's leading geoscientific center and repository for their lunar samples.

Russian scientists have been invited to describe their analyses of the Luna 24 samples at the Eighth Annual Lunar Science Conference, to be held next month in Houston. These conferences, which have been held yearly since the first Moon rocks were obtained by the Apollo program in 1969, are a major event in the presentation of lunar and planetary science results.

The agreement under which the American and Russian lunar samples are exchanged was negotiated between NASA and the U.S.S.R. Academy of Sciences in 1971. The agreement provides for the exchange of lunar scientific data between Russian and American scientists and for scientific visits between the two countries. The agreement also provides for the future exchange of lunar samples.

## Courses in Space Futures

Dr. Jesco von Puttkamer of NASA's Office of Space Flight taught a science course described as "an expanded view of the space program" at the Smithsonian Institution in Washington, D.C. during November. His classes, under the title "Beyond Mars: Toward 2076," were conducted for the benefit of some 50 members of the Smithsonian Associates/ Resident Program.

Von Puttkamer's lectures were devoted to four subjects: Mankind in Space—the Long-Range View; Space Industrialization: Space Station and Space Construction Base; Space Industrialization: Lunar Base; and Space Settlement and Beyond. Speaking extemporaneously much of the time, his lectures were wide-ranging, from assessments of current NASA programs through descriptions of the basic principles of space stations and settlements on the Moon and to speculation on the far future of humanity when space settlements in his words, "may become 'space arks', taking mankind—with the help of advanced technology—to the stars."

Copies of the lectures are not available, but an abridged version of von Puttkamer's presentation is available under the title "The Next 25 Years: Industrialization of Space." He is program manager, space industrialization and integrated long-range planning studies in the Office of Space Flight, NASA headquarters.

## A Veteran Retires

A book about how America's rocket ships travelled through Hancock County, Miss., enroute to the Moon, would make mighty interesting reading and the person probably best qualified to write about NASA's National Space Technology Laboratories (formerly called the Mississippi Test Facility) is Mrs. Mary Blanchard, of Waveland, Miss.

She has been part of the NASA facility since its beginning, when the Army Corps of Engineers in 1962 opened its office to acquire the land for the spectacular

Project Apollo to "land a man on the Moon and return him safely to Earth." She returned to full-time work after all her nine children had completed their public school education. Mrs. Blanchard retired last Nov. 30, after 12 years with NASA.

When she joined the Corps of Engineers real estate project office in Bay St. Louis, the corps was responsible for the administration of the acquisition of some 141,000 acres of land in Hancock and Pearl River Counties in Mississippi and in St. Tammany Parish in Louisiana.

She recalls: "It was a difficult time for the Government and landowners, who, understandingly, were unhappy at having to part with their homesteads."

When the land acquisition was nearing completion, Mrs. Blanchard transferred to the Corps' Area Engineer Office at the "test site," where the Corps was charged with construction of facilities. This, she said, was an interesting time, when one could see structures rising and roads being cut in an area that was once mostly piney woods and cypress swamp along the East Pearl River.

**Recent Retiree**—Mrs. Mary Blanchard is shown in a familiar setting as she updates volumes in the NSTL legal library. She retired from NASA after 15 years of service at the end of November.

When construction was in its final phase, she transferred to NASA in 1965 to become secretary to the legal officer. "It was tremendously exciting to me to be a part of humanity's search for a new frontier. It was awesome to see the powerful rockets fired."

She has many memories of the excitement of the Apollo launches when employees viewed the countdowns with apprehension and cheered jubilantly at the safe returns of the astronauts.

"We all felt that we had a real part in that vast mission," she said.

In 1966, Mrs. Blanchard became the first employee at NSTL to receive the NASA Superior Performance Award. In 1971, she received the Marshall Space Flight Center Director's Commendation Certificate "For exemplary efficiency in assisting the legal officer in the activation and operation of the office during Apollo/Saturn V testing activities at the Mississippi Test Facility." In 1975, NASA awarded her a second Quality Performance Award.

Mrs. Blanchard's last assignment was as assistant to the NSTL public affairs officer.

The Blanchard family has lived in the Bay St. Louis area since 1940.

## Shuttle Road Bridges Ancient Indian Campsite

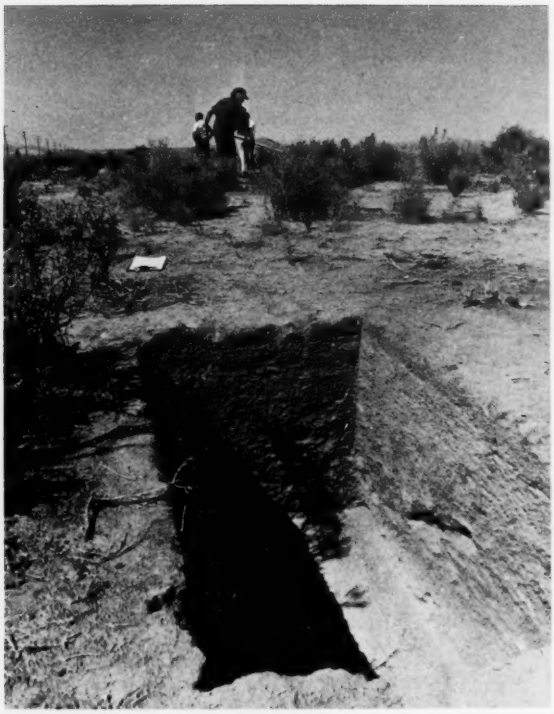
*Most of the following article was excerpted from the Dryden Flight Research Center's publication,* X-Press.

NASA has become involved in the field of archeology but not "in search of ancient astronauts." The road built to transport the Space Shuttle orbiter, *Enterprise*, to the Dryden center from the Rockwell site in Palmdale will preserve a prehistoric Indian campsite.

The site was discovered during a routine investigation conducted to determine the environmental impact of the construction of the road. After preliminary investigation to determine the extent of the site, the Shuttle road was built over it so as to preserve the campground for future excavation.

The site is easily identifiable on the surface by the midden (dark soil caused by decomposition of organic material) dug up by rodents, and the flakes (waste pieces of worked stone) in the vicinity. It is located on government property, directly in the path of the Shuttle road, which is an extension of Division Street.

The campsite probably was situated at the shore of Rosamond Lake which, like many of the lakebeds in the region, was a wet lake until a 1920 earthquake dropped the water table and caused lakes to dry out.



**Archeological "Find"**—An area dug out by archeologists along the route over which the Space Shuttle will travel to its Dryden Flight Research Center destination. Scientific evidence revealed ancient Indian relics.

**Bits and Pieces**—The archeologists sifted debris in an effort to find evidence of an ancient Indian campsite on a newly constructed road in Palmdale, Calif.

According to archeologist Van Eggers (of the consulting firm Environmental Impact Service, Inc.), the site probably was just a campsite used by the Indians while traveling from one end of the valley to the other. His crew of local experienced acheologists has uncovered several artifacts, including rhyolite and obsidian flakes, a spear or knife point, and a piece of grinding stone. A single olivella bead—probably an Indian form of money and usually found only in burial sites—was found in the bottom 10-centimeter level of a 1½-meter test unit dug out of the soil. Charcoal, and rodent and bird bone also were located.

The team of archeologists was made up of Eggers, Roger Robinson and Mark Sutton of Antelope Valley College, aided by 12 assistants. Objects collected from six test units dug at 10-cm. levels were sorted, counted, labeled, catalogued and stored through use of Antelope Valley College facilities. The Shuttle road is constructed to avoid driving directly over the site, to minimize damage to the archeological digging area. It will be thoroughly investigated at a future date.

## Three Executives Tapped for Presidential Job Swap

David M. Spindle of the Combustion Engineering Co., Hobbs, N.M.; and C. Jackson Pfeffer of the Xerox Corp., Dallas, Texas, began one-year assignments in November with NASA under the government program called the President's Executive Interchange Program.

NASA employee Francis T. Hoban reversed the process, to become a member of the General Motors Corp. in Detroit. There he will assist in the formation of a new organization for non-product central buying in the Detroit area.

Spindle works as a marketing analyst at NASA. His duties include developing policy directives for international and domestic marketing of the Space Transportation System (Space Shuttle).

Pfeffer's assignment is as special assistant to the Administrator for International Affairs. His primary assignment is to study methods and strategies for pricing foreign use of Landsat products such as surveys of land-mass crops, forestry and Earth resources.

The men are among 33 business executives, four educators and 17 government officials selected for this year's program.

The unique job-exchange program, now in its seventh year, enables high-potential business executives and educators to change places with senior government officials and work in responsible positions in the opposite sector for about a year.

The nomination and selection of the program's participants are based on evaluations of leadership and management abilities, professional accomplishments and potential as senior executives of their organizations.

"Benefits to the individuals as well as to the host and sponsoring organizations are substantial," says Jay F. Morris, executive director of the program. "The exchange of management techniques, coupled with the new perspectives brought by the visiting executives, helps to improve operations and contribute to the efficiency of the host organization," said Morris.

"The Nation benefits as well by the development of a cadre of promising leaders in government, education and industry who have both the ability and the broad-based experience to deal effectively with complex national issues in future years," Morris added.

Spindle, 33, joined Combustion Engineering, Natco Process Equipment Division in 1962. Since then he has held numerous positions including office manager, equipment technician, electronic technician, branch technician and marketing manager. He has been senior branch manager of the Hobbs, N.M. area (including portions of Texas and New Mexico) since 1974. In that capacity, he was responsible for the manufacturing, sales and service of process equipment for the oil and gas industry.

*Spindle*

Pfeffer, 44, held several planning positions for the McDonnell-Douglas Corp. in St. Louis, Mo., before joining Xerox. From 1969 to 1974, he held increasingly responsible positions with Xerox in program management and product development. In 1974, Pfeffer became manager of planning and analysis for the newly formed Xerox office systems division in Dallas. In that capacity, he led planning programs in the division for new products and provided direct staff support for the president of the division.

*Pfeffer*

Hoban, 41, who joined NASA in 1963, was the first administrative intern at the Langley Research Center. After a one-year tour at NASA headquarters, Hoban rejoined the Langley center as head of the research and development budget office. In 1970, he became a member of the NASA Administrator's staff as an assistant executive officer. Since 1973, Hoban has been the manager, business practices, in NASA's low cost systems office.

*Hoban*

## Pioneer Customers for Space Shuttle

The first four customers have signed up with NASA for small, self-contained payloads to be flown aboard Space Shuttles on a space-available basis beginning in 1980.

Each of the payloads, dubbed "getaway specials" by NASA's Associate Administrator for Space Flight John F. Yardley, weighs 91 kilograms (200 pounds) or less, measures less than .14 cubic meters (five cubic feet), is for research and development purposes, and requires no additional Space Shuttle services such as electrical power or deployment in space. In effect, the small payloads can be tucked away in a corner of the spacecraft.

Cost of the service will be negotiated on the basis of the size and weight of the package, but will not exceed $10,000 in 1975 dollars. Minimum charge will be $3,000, also in 1975 dollars.

Each of the four customers who have signed up for the "special" have deposited $500 earnest money with NASA, which sum will be applied to the final cost of the service.

The four customers, in order of signing, are:

R. Gilbert Moore, a private citizen from Ogden, Utah, who plans to place research equipment in his payload. He has offered half his payload to Utah State University which will, in turn, offer the space to selected high schools whose students will be asked to submit proposals for experiments to be included. Tuition fees will be waived at Utah State for the selected students and they will be able to earn additional money by working with faculty members involved in space sciences.

**Space Shuttle Reservation**—Reiner Klett of Germany hands $1,000 in advance fees for participation in Space Shuttle "getaway special" to David Spindle, NASA marketing analyst for STS operations.

**In the Vanguard for Space Experiments**—Dr. L. R. Megill (signing check) submits $500 earnest money for the purchase of a Space Shuttle payload to Capt. Chester M. Lee (at Megill's left), director of the Space Transportation Systems operations. J. Michael Smith, director of STS planning and requirements and Donna Skidmore, administrative officer for STS operations are seated at left.

Dr. L. R. Megill, chairman of the space science experiment committee at Utah State, personally will fund a $3,000 payload as a follow-on to Moore's. He also plans to invite students to submit proposals.

Reiner Klett, a German consultant representing independent German researchers, has signed for two $10,000 payloads. One of these will be for a space-processing experiment, the other for a biological experiment.

Battelle Memorial Institute purchased two $10,000 payloads to be used in the field of materials science.

NASA is seeking customers for larger payloads for Space Shuttle missions. The agency is negotiating with COMSAT to fly three missions which will place Intelsat V communications satellites in Earth orbit.

The reusable Space Shuttle vehicle will be launched like a rocket and will land like an airplane on a runway after completion of its space missions. It will be capable of carrying payloads of up to 28,500 kg. (65,000 lbs.) in a payload bay that measures 18 m. (60 ft.) long and 4.5 m. (15 ft.) in diameter.

Space Shuttle orbital flight tests begin in 1979, operational flights in 1980. By 1984, the space agency expects to be conducting up to 60 Space Shuttle missions a year from launch sites at the Kennedy Space Center and from the Vandenberg Air Force Base.

Space Shuttle missions will be flown for NASA, for the Department of Defense and other government agencies, for private corporations and for international customers. Payloads include Spacelab (now being built by the European Space Agency); spacecraft devoted to activities concerning weather, Earth resources and communications; and scientific and other kinds of satellites.

## Prospectus

*The Next Five Years*

From April to October of last year, a comprehensive study was conducted at all levels of NASA to identify specific goals for aeronautical and space activities during the next five years.

The goal for aeronautics is the assurance of United States preeminence in aviation, supplying a technology base that will enable our country to continue developing superior civil and military aircraft embodying improved design, materials and propulsion, able to compete successfully in the world market.

That goal will be pursued in the coming five years along two routes: technological advances focused on specific existing needs, and long-range research for continued growth and improvement. Programs will be directed toward improving the energy efficiency of conventional aircraft engines, and to developing aircraft that make increased use of lightweight, high-strength materials, advanced aerodynamics and improved control systems.

Efforts will be made in general aviation to apply advances in aerodynamics, structures, propulsion and electronics, and to improve the efficiency and techniques of aerial crop treatment. Other programs, closely coordinated with the Department of Defense, include work on an advanced Short Takeoff and Landing (STOL) aircraft, modifications of existing military STOL aircraft and joint research with the U.S. Navy on the lift-fan vertical takeoff and landing vehicle. In 1981, tests will begin that will lead to a new generation of civil helicopters in the mid-1980's. Research also will be conducted on supersonic aircraft engines, inlets and flight controls, and on hypersonic vehicle technology.

An important goal for NASA's activities in space was established as the scientific exploration of the solar system and the universe in the continuing quest for answers to the external questions of life, matter and energy.

That goal will be approached in a variety of ways.

A Pioneer orbiter spacecraft will launch for Venus in May of 1978, arriving in Venusian orbit in December. It will be followed in August by a multi-probe mission scheduled to enter the Venusian atmosphere six days after the arrival of the orbiter. While the probes sound the planet's atmosphere, measuring structure, composition, clouds, wind speed, energy balance and general circulation patterns, the orbiter will map the Venusian upper atmosphere and ionosphere directly and the lower atmosphere by remote sensing and radio occultation. It also will study the planetary surface by remote sensing, remaining in orbit for at least one Venusian year (225 Earth days).

In 1980, NASA proposes to launch a radar orbiter that will be able to "see" through the Venusian cloud layers and provide a radar map of about 35 percent of the planet's surface.

Serious consideration is being given to a Viking mobile lander for launch in 1981 to investigate new areas of the Martian surface.

An additional mission to Mars, proposed for 1986, would return a sample of Martian soil to Earth.

A Jupiter orbiter-probe is planned for launch in 1981 to investigate the pressure, temperature, density and composition of the planet's atmosphere, map its magnetic field, and identify the major global features of the planet and its satellites.

A pair of Saturn-Uranus probes, planned for launch in 1985 and 1986, will furnish similar atmospheric surveys of those two planets during encounters in 1988 and 1992 respectively.

Advanced technology studies are underway on two promising propulsion systems for interplanetary missions in the next decade—solar sailing that uses the pressure from photons streaming outward from the Sun and impinging on a large, lightweight, reflective surface (or sail) for propulsion; and a solar electric propulsion engine.

If the concept of solar sailing fulfills our expectations, plans will be made to "sail" a spacecraft to a rendezvous with Halley's Comet, departing Earth in 1982.

NASA's scientific investigations outside the solar system are centered on a 2.4-meter space telescope that will extend humanity's vision seven times farther into space than has been possible heretofore, making possible quantitative investigations of quasars and individual stars outside our galaxy. Determinations may be possible concerning whether nearby stars have planetary systems. The telescope also may allow scientists to see far into the universe to the most distant stars, so far out in fact that the light of those stars takes over 10 billion years to reach Earth. Thus scientists may be able to observe events that took place 10 billion years ago—almost to the beginning of time as we know it in our universe.

The space telescope is planned for launch in the

early 1980s and NASA proposes to follow it with an infrared telescope in 1983 and an ultraviolet instrument in 1985. The three telescopes will complement each other, with the ultraviolet and infrared instruments performing surveys to locate specific objects for more detailed study by the space telescope.

Of more immediate potential benefit to our home planet and the creatures that inhabit it are the Solar Maximum Missions planned for launch in 1979 to improve our understanding of solar flares. Additionally, several explorer missions are scheduled for 1978 and 1983 to study the interactions between the solar wind and the Earth's magnetosphere as well as the processes that couple the magnetosphere with the ionosphere, the atmosphere and special plasma.

Beginning with the first operational flights of the Space Transportation System in mid-1980, Spacelab will continue solar flare studies. Then, in 1983, the Spacelab/Shuttle combination will begin an integrated set of investigations of the atmosphere, magnetosphere and plasmas in space with flights approximately every six months.

The versatile Spacelab also will conduct a series of life-science missions beginning in 1980, with the objectives of insuring human well-being in space, applying space technology to medical and biological problems and increasing our understanding of the origin and distribution of life in the universe. Spacelab will be supplemented in this effort by an unmanned Biomedical Experiment Scientific Satellite, conducting studies of plants and small animals in space over periods of six months or more.

A second NASA space goal is to concurrently provide near-term benefits for all people, through the provision of space-based observation systems that can supply worldwide data—on a timely basis—related to the environment and to environmental phenomena that might affect world economics.

In pursuing that goal, a whole range of advanced Landsat, Seasat, Nimbus and Tiros spacecraft are planned for launch throughout the five-year period. These, to be launched and managed in conjunction with other government agencies, user organizations and ground facilities, are expected to furnish Earth inhabitants with the unprecedented and invaluable ability to:

- predict global wheat production, survey rangeland conditions and major metropolitan areas, and monitor and inventory surface mining by 1981;
- begin the monitoring of ocean currents and circulation patterns, air/sea boundary conditions and sea-surface topography in 1981;
- forecast global production of all major crops by 1983;
- begin comprehensive monitoring of the global environment in 1983;
- achieve, through use of other systems too complex to list in this article, reliable weather forecasting beyond three days by 1984, and effective storm predictions by 1986.

The final goal defined for NASA is to establish a permanent U.S. presence in space, to help guarantee to all peoples free access to space for peaceful purposes, ensuring the benefits of the unique environment of space not only for our own people but opening new horizons for the human spirit.

A permanent presence in space becomes feasible for the first time with the introduction of the reusable Space Shuttle scheduled for its first manned orbital flight in mid-1979 and the start of regular operations a year later. The easy, routine and relatively inexpensive access to space to be provided by the Space Shuttle will be an aid to, among other things, the creation of a space construction base proposed for development beginning in 1980 and initial use in 1985. This facility can serve as a base for the industrialization of space, for the construction of large space structures used as solar energy collectors and communications antennas, and for the operation of automated space systems. It also can be a servicing center for other orbiting vehicles such as the space telescope.

The space construction base also would form a highly visible reminder of the continuing peaceful technological leadership of the United States. ■■■

# Did You Know?

**Seventeen of 23 launches scheduled for 1977** will be the responsibility of the Kennedy Space Center, which will use 11 Deltas, four Atlas Centaurs and two Titan Centaurs for the launches. Ten of the Deltas will be launched from Complex 17, Cape Canaveral Air Force Station and one from a KSC launch pad at the Western Test Range in California. The four Atlas Centaurs will be launched from Complex 36, Cape Canaveral, and the two Titan Centaurs from Complex 41 on the Cape.

**Students in one university are able to take courses in another** thousands of miles away, via the world's most powerful satellite of its kind, the CTS or Communications Technology Satellite. Engineering classes and seminars at Stanford University in California are being televised to Carleton University, 2,500 miles away in Ottawa, Ontario, and vice versa. In addition, scientists and engineers at NASA's Ames Research Center—which provides the link between the CTS and Stanford—participate in three-way video conferences. NASA and Canada's Department of Communications are partners in the educational experiment.

**Former NASA flight surgeon Dr. Clarence Jernigan** has joined the faculty of the University of Texas Medical Branch at Galveston as an assistant professor in the department of family medicine. From 1964 to 1972, he was involved in five moon landing missions and was isolated as the attending physician for the Apollo 12 astronauts.

**NASA's Nimbus-4 weather statellite,** carrying onboard ozone detection instrumentation, has monitored hydrogen bomb effects on the global ozone layer and over China and the Pacific Ocean attributable to the four-megaton hydrogen bomb set off in China last November. Results are called inconclusive by the team of scientists who conducted the tests at the Goddard Space Flight Center. If their measurments are correct, however, the scientists say that such a large explosion could, at least temporarily, deplete the ozone layer by a detectable amount over the Pacific and east of the Chinese explosion site.

**NASA is modifying some of the Saturn-Apollo equipment and facilities** used in the Apollo, Skylab and Apollo Soyuz programs for use in future space programs and is taking steps to dispose of remaining Saturn-Apollo hardware that has no future application. The move marks the transition to a new phase of the space age—from an era of exploration of space to a time of emphasis on the exploitation of near-Earth space for humanity's benefit. By disposing of obsolete hardware, the agency will eliminate storage costs, free space, and make facilities available for currently operative programs. Much of the Saturn-Apollo hardware will be turned over to the Smithsonian Institution. Other equipment is being screened for possible use in the Space Shuttle program or in others.

**During a nationally syndicated TV news program** aired New Year's Day, columnist George Will proposed that NASA's Viking mission be designated as TIME Magazine's "Person/Event of the Year."

**The Public Broadcasting System** (in D.C., channel 26, WETA ) will show six segments of the Jacques Cousteau series; entitled "Oasis in Space" in February, March and April. Specific dates are: Feb. 22, What Price Progress; March 1, Grain of Conscience; March 8, Troubled Waters; March 22, Population Time Bomb; March 29, The Power Game; and April 25, Vision of Tomorrow. ■■■

## Correcting an Impression

William B. Krabill, DAS/GEOS-3 C-Band Data Manager at NASA's Wallops Flight Center, sent in the following comments with reference to an article on page 6, *NASA Activities* for December 1976:

"The statement that 'the Ely radar is the most accurate C-Band radar in the world' is not correct. It is probably a misquote of a statement I made in response to a question from the Ely Project Personnel about our findings concerning performance on GEOS by their radar. My response was as follows: 'The Ely radar is *one of* the most accurate C-Band radars in the world.' There are a number of C-Band radars that have performed at the one-meter level in support of the GEOS-3 project. It is a disservice to the excellent NASA radar crews at Bermuda, Wallops and Hawaii, as well as at the numerous DOD radars, for Ely to be

singled out. This is not intended in any way to discredit the performance of the Ely radar, as my statement above is valid based on our analysis of GEOS-3 tracking data. The Ely radar always provides excellent support to the GEOS-3 project, diligently following procedures and supplying high-quality data in a timely manner."

## New Division Director at Headquarters

Curtis M. Graves became NASA's Director of Community Affairs Division last Jan. 3. He comes to NASA from the National Civil Service League, where he was managing associate for continuing education and administration from 1973 to 1977. Before that, he served for six years as a member of the Texas State House of Representatives, elected from a Houston district. In 1966 he become the first black person to be elected to the Texas legislature in 75 years.

Graves' experience includes former positions as advertising manager and editor of two Houston newspapers and comptroller and branch manager of a savings and loan association.

As Director of Community Affairs, Graves reports to the Assistant Administrator for Public Affairs. His responsibilities are to encourage and maintain the agency's communications and relations with communities in which NASA centers and installations are located. His office is concerned with promoting an understanding of NASA's economic and social impact on areas surrounding its installations—by citizens of these communities and by NASA personnel nationwide.

Born in New Orleans, Graves earned his bachelor's degree in business administration from Texas Southern University in Houston. He was awarded an honorary doctorate from Union Baptist Bible College, Houston.

His awards and honors include: the Delta Sigma Theta Sorority Award for Outstanding Leadership, the National Association of College Women's Award for Achievement, the Kappa Alpha Psi Fraternity Awards for Outstanding Achievement and Service to Mankind and Texas Southern University's Outstanding Alumnus Award.

**Firmly Behind Energy Savings**—Dr. Gil Yanow (left) and Gil Herrera of NASA's Jet Propulsion Laboratory head an energy saving program called Alternate Consumer Energy Society or "ACES." The organization functions to bring to the attention of energy users ways in which they can combat the energy crunch. Their efforts are broad-based, encompassing: education programs about technical material and systems such as solar collectors, wind-powered equipment and methane generators; buyer services such as promoting the purchase of low-interest loans for the purchase of energy-savers in homes, as well as discounts on various purchases; technical assistance for do-it-yourselfers; and a public forum featuring monthly meetings for discussions of energy-related matters. The meetings have been well attended and discussions have centered on such matters as energy conservation in the home; solar heating for swimming pools; methane production; wind generators; solar heating for residences; and solar energy and education.

**Major Award to Langley Scientist**—Dr. Richard W. Barnwell of Langley's subsonic-transonic aerodynamics division holds the H.J.E. Reid award, given in a recent ceremony at the Langley center. His paper, entitled "Analysis of Transonic Flow about Lifting Wing-body Configurations," was selected as the outstanding technical paper of the year. Congratulating him are Rep. Thomas N. Downing (left) and Langley director Donald P. Hearth.

## Contractor News

**United Space Boosters, Inc.** of Sunnyvale, California (a wholly owned subsidiary of United Technologies Corp.) has been chosen by NASA as the assembly contractor for the Space Shuttle solid rocket booster. A cost-plus-award-fee contract was negotiated for $122 million, which includes the maximum potential award fee. The contract is for six design, development, test and evaluation flights scheduled to extend through March 1980, plus options for 21 operational flights into 1982. The booster assembly contract covers all necessary activities at the Marshall and Kennedy centers.

**General Electric Co.** at Edwards Air Force Base was awarded a contract for aircraft engine maintenance, modification and repair by the Dryden Flight Research Center. The cost-plus-fixed-fee contract is for a year, with provisions for two one-year extensions. Estimated cost for the first year is set at about $1.3 million.

Contracts negotiated by the Langley Research Center with the **Boeing Co.** of Seattle, the **McDonnell Douglas Corp.** of St. Louis, and the **Lockheed Aircraft Corp.** of Burbank, Calif. center on evaluation of a fuel-saving concept for commercial subsonic transport aircraft. Each firm has estimated its cost of the cost-plus-fixed-fee contract at about $1.6 million. Contracts cover 24 months.

**The Systems and Applied Science Corp.** of Riverdale, Md. won a contract to provide and maintain computer software for the Nimbus-G project. NASA's Goddard Space Flight Center granted the cost-plus-fixed-fee contract, worth $1.4 milion to the minority-owned firm. It is the first million-dollar-plus contract awarded by Goddard to a minority firm and it brings the center's minority contract total to more than $13 million. The corresponding NASA-wide figure now totals $80 million.

**The McDonnell Douglas Corp.** of Huntington Beach, Calif. is developing a solid-propellant upper-stage for use in future Space Shuttle missions. Under an unusual agreement between NASA and the corporation, it will build and market the stage, using its own funding and initiative. The upper stage is destined to carry payloads weighing up to 1,100 kilograms (2,450 pounds) into synchronous orbit, these to be inserted into low Earth orbit by the Shuttle. Under agreement terms, McDonnell Douglas may market the upper stage hardware and services either directly to users or through NASA.

**Aeronutronic Ford Corp.,** a subsidiary of the Ford Motor Co., changed its name to Ford Aerospace & Communications Corp., effective Dec. 1, 1976. The organizational structure of the corporation will remain the same, with divisions continuing under two separate components—aerospace and communications operations and consumer products operations.

The minority business, **Technology Development Corp.** has received a contract from the Dryden center for computer software engineering support for the center's F-15 flight test program. The fixed-price contract, worth $94,791, has two six-month options.

**Owen Enterprises, Inc.** of Wilmington, Calif. received a NASA exclusive patent license for the production of a unique solar-energy concentrator that focuses solar rays at almost any angle without requiring a Sun tracking mechanism. The device was invented by Dr. Katsunori Shimada of the Jet Propulsion Laboratory and patented by NASA. Owen Enterprises, Inc., is owned and operated by American Indians. The company will invest $200,000 to develop the concentrator and, after it begins production (in about six months), will pay a one percent royalty of gross sales to the U.S. Treasury.

**Energy Concentrator**—Charles A. Owen (left), president of Owen Enterprises, Inc., Wilmington, Calif., and Dr. Katsuneri Shimada of NASA's Jet Propulsion Laboratory, check out the prototype of a unique solar energy concentrator invented by Dr. Shimada. The device can focus the sun's rays from almost any angle without the need of a sun-tracking mechanism.

**McDonnell Douglas Astronautics Co. East,** of St. Louis, Mo., has been selected for negotiation of a contract to provide the power module subsystem for the solar maximum mission spacecraft. The contractor's proposed value of the contract is about $2.3 million, exclusive of options. The firm will provide one protoflight model for the mission, with options for up to six additional power-module subsystems. To be launched in the third quarter of 1979, the SMM will carry instruments to investigate solar flares. In a related action, NASA also selected **Fairchild Industries** of Germantown, Md., for negotiation of a contract, valued at about $2.5 million, to provide the communication and data handling for the same spacecraft. The first will provide one protoflight model for the program with options for up to six additional data-handling subsystems. **General Electric Space Div.** of Valley Forge, Pa., was chosen for negotiation of a contract to provide the attitude control subsystem for the SMM spacecraft. The value of the contract is about $3.5 million. It calls for one protoflight model for the mission program, with options for up to six additional attitude control subsystems. The SMM project will be managed for NASA's Office of Space Science by the Goddard center. ■ ■ ■

**Pioneer-10 Vehicle Presented to Space Museum**—Ceremonies held in mid-January at the Smithsonian Institution's National Air and Space Museum marked the presentation of the Pioneer 10 back-up vehicle and commemmorative paintings to the museum director, former Astronaut Michael Collins (center). Pictured from right to left are: Dr. Adolph Thiel, Senior Vice President of the TRW Defense and Space Systems Group; Charles Hall, manager of the Pioneer project, from NASA's Ames Research Center; Collins; NASA Administrator Dr. James C. Fletcher; and Dr. John Wolfe, Pioneer 10 project scientist from the Ames center.

**Unique Christmas Present**—The Ames UH-12E Hiller helicopter completed its last official mission as it was welcomed by students and the school band at San Jose's Independence High School (Calif.) just before Christmas. The craft was declared surplus and consigned to the school, where it serves as a classroom teaching aid for future aircraft mechanics and pilots.

**American Indians Meet**—Standing before a display case filled with native American Indian artifacts at the Dryden Flight Research Center are (l. to r.) Jerry Elliot, American Indian coordinator from JSC; David Lester, president of the United Indian Development of Los Angeles; and Harlan Hall, of Indian Centers Inc. The three met during Native American Indian Awareness Week (October) to discuss business opportunities for American Indians in the western United States. The display belongs to a Dryden employee, Sammie Jester. The kachina dolls in the case were made by her 92-year-old father, a full-blooded Hopi Indian.

## Patents for Inventions from NASA Research

*The Office of General Counsel, NASA headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel for the indicated installation.*

| Inventor(s) and Employer(s) | Title & NASA Docket | Patent No. | Installation |
|---|---|---|---|
| John L. Burch, NASA/MSFC | Actuator Device for Artificial Leg | 3,995,324 | MSFC |
| Ira S. Hoffman, NASA/LARC | Miniature Biaxial Strain Transducer | 3,995,476 | LARC |
| Morriss L. Holliday, NASA/LARC | Precision Alinement Apparatus for Cutting Workpiece | 3,995,522 | LARC |
| John J. DeLuca, Wayne E. Hughes, NASA/GSFC | Hydrogen Fueled Rotary Engine | 3,995,600 | GSFC |
| William Elkins, Ernest Glenn Tickner, Acurex Corp., Mountain View, Calif., Bill Alvin Williams, NASA/ARC | Liquid Cooled Brassiere and Method of Diagnosing Malignant Tumors Therewith | 3,995,621 | ARC |
| Walter E. Parsons, NASA/KSC | Percutaneous Connector Device | 3,995,644 | KSC |
| Clinton E. Carle, NASA/GSFC | Reel Safety Brake | 3,995,789 | GSFC |
| William P. Albrecht, Ralph H. Sparks, NASA/DFRC | Fifth Wheel | 3,995,877 | DFRC/NRLO |
| Lars-Goran Rosengren, Caltech/JPL, Pasadena, Calif. | Method and Apparatus for Background Signal Reduction In Opto-Acoustic Absorption | 3,995,960 | NRLO |
| Lawrence H. Thaller, NASA/LERC | Electrically Rechargeable Redox Flow Cell | 3,996,064 | LERC |
| Jacob D. Broder, NASA/LERC | Silicon Nitride Coated, Plastic Covered Solar Cell | 3,996,067 | LERC |
| Walter B. Powell, Lee R. Potter, Kenton S. MacDavid, Caltech/JPL, Pasadena, Calif. | Thermocouple Installation | 3,996,070 | NRLO |
| David H. Schaefer, James P. Strong, III, NASA/GSFC | Two-Dimensional Radiant Energy Array Computers and Computing Devices | 3,996,455 | GSFC |
| David L. Farnsworth, Westinghouse Electric Corp., Baltimore, Md. | Solid-State Current Transformer | 3,996,462 | MSFC |
| Charles E. Giffin, Leonard M. Sieradski, Alfred O. Nier, Caltech/JPL, Pasadena, Calif. | Mass Spectrometer with Magnetic Pole Pieces Providing the Magnetic Fields for Both the Magnetic Sector and an Ion-Type Vacuum Pump | 3,996,464 | NRLO |

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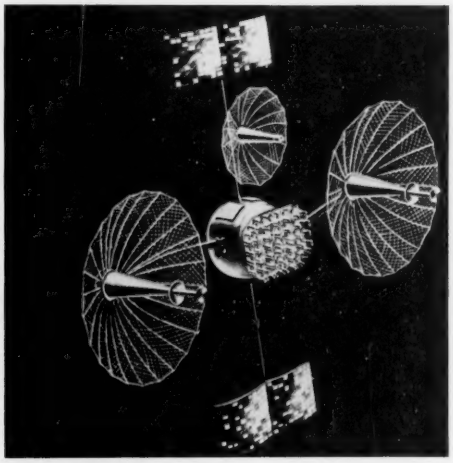
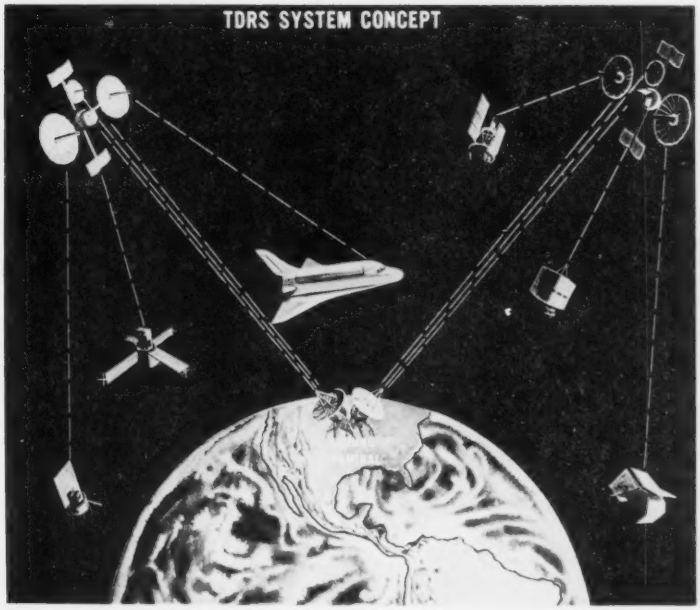
|---|---|---|---|
| Klaus Heinemann, National Research Council, Washington, D.C. | Electron Microscope Aperture System | 3,996,468 | ARC |
| John R. Cameron, Philip F. Judy, Univ. of Wisconsin, Madison, Wis. | Method and System for in Vivo Measurement of Bone Tissue Using a Two Level Energy Source | 3,996,471 | JSC |
| Robert A. Kichak, NASA/GSFC | Inrush Current Limiter | 3,996,506 | GSFC |
| Chase P. Hearn, Richard H. Couch, NASA/LARC, Lewis R. Wilson, LTV Aerospace Corp., Hampton, Va. | Phase Modulating With Odd and Even Finite Power Series of a Modulating Signal | 3,996,532 | LARC |
| Ronnie R. Rippy, NASA/GSFC | Linear Phase Demodulator Including a Phase Locked Loop with Auxiliary Feedback Loop | 3,997,848 | GSFC |
| Robert A. Ormiston, William G. Bousman, NASA/ARC, Dewey H. Hodges, U.S. Army Air Mobility, David A. Peters, R&D Laboratory, Calif. | Hingleless Helicopter Rotor | 3,999,886 | ARC |



**A Unit of the TDRSS**—An artist's concept of one of the satellites in the system shows a satellite with two steerable dishes about five meters (16 feet) in diameter. Projecting from the center of the dishes are the feeds which concentrate the energy from the dishes. Solar panels are on booms extending perpendicularly to the big dish axis. In the center is the spacecraft bus from which the phased array antenna elements project. The smaller dish is the space-to-ground link. The picture is the NASA concept that was furnished to all bidders, but the actual hardware to fly later in this decade will differ in many aspects from the drawing. The TDRSS network will use two such spacecraft in synchronous orbit.

**Tracking and Data Relay Satellite System**—The TDRSS will be built and operated for NASA by Western Union Space Communications, Inc. Photo shows how the system will track manned and unmanned Earth-orbiting spacecraft, replacing many ground stations throughout the world. Each TDRSS satellite will be a self-contained system that will include antennas, power and communications repeaters, which will relay information between the TDRSS ground station and the user spacecraft.



**Award at Marshall**—The Alabama Society of Professional Engineers recently presented NASA's Marshall center with its "Wonder of Engineering" award, in recognition of the center's role in the NASA-American Society of Engineering Educational summer fellowship program. Under the director of Auburn University, the program produced a study called "Ecastar" in 1975. The project was a comprehensive study of actions that might be taken to conserve energy, how to carry out such actions, and potential impact they might have on society and the environment. Shown at the presentation are (l. to r.) J. Fred O'Brien, associate director of Auburn University Extension Service; Dr. Randy Humphries of Marshall; Dr. Reginald I. Vachon of Auburn; Alton S. Little, ASPE president; Dean of Engineering at Auburn Vincent Haneman; and Dr. William R. Lucas, Marshall director.

## Planned Launches for 1977

| Name | Launch Date | Vehicle | Range | Mission Remarks |
|---|---|---|---|---|
| NATO-III B | Jan. | Delta | ETR | Second communications satellite in synchronous orbit to perform communications relay for NATO. Reimbursable. |
| Palapa-B | March | Delta | ETR | Back-up satellite for Indonesian domestic communications network. Reimbursable. |
| HEAO-A | April | Atlas/Centaur | ETR | High Energy Astronomical Observatory to study very energetic radiation from space. |
| GEOS/ESA | April | Delta | ETR | ESA spacecraft to conduct scientific investigation of waves and particles in magnetosphere. Reimbursable. |
| GOES-B | May | Delta | ETR | Second operational satellite to provide continuous daytime and nighttime global cloud cover observations for NOAA. Reimbursable. |
| OTS/ESA | June | Delta | ETR | Orbital Test Satellite. ESA experimental communications satellite. Reimbursable. |
| Intelsat IVA-C | June | Atlas/Centaur | ETR | Follow-on series of improved communications satellite for Comsat. Reimbursable. |
| Navy-19 | June | Scout | WTR | Navy navigation satellite. Reimbursable (call-up). |
| GMS-A | July | Delta | ETR | Geosynchronous Meteorological Satellite. Japanese portion of global network of geostationary environmental satellites. Reimbursable. |
| SIRIO-A | Aug. | Delta | ETR | Italian project to investigate radio propagation, trapped radiation flux, magnetic field intensity and variation, and the primary electron energy spectrum. Reimbursable. |
| Meteosat | Aug. | Delta | ETR | ESA meteorological satellite. Reimbursable. |
| MJS-A | Aug. | Titan III Centaur | ETR | Mariner/Jupiter/Saturn mission to conduct exploratory investigation of the Jupiter and Saturn planetary systems and the interplanetary medium out to Saturn. |
| MJS-B | Aug. | Titan III Centaur | ETR | Same as MJS-A. |
| Landsat-C | Sept. | Delta | WTR | Third Earth resources technology satellite. |
| RCA-C | Sept. | Delta | ETR | Third domestic communications satellite for RCA. Reimbursable. |

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| Intelsat IVA-D | Oct. | Atlas/Centaur | ETR | Follow-on series of improved communications satellites for Comsat. Reimbursable. |
| ISEE-A/B | Oct. | Delta | ETR | International Sun-Earth Explorer. Joint NASA/ESA mission to study the interaction of the interplanetary medium with Earth's immediate environment, the magnetospheric bow shock and magnetosheath, and measure the characteristics of the interplanetary medium away from Earth's perturbing influence. |
| FltSatcom-A | Oct. | Atlas/Centaur | ETR | Navy Fleet Satellite Communications. Reimbursable. |
| UK-6 | Oct. | Scout | WTR | Measure ultra-heavy cosmic ray particles and study low-energy cosmic X-rays and the fast secular behavior of X-ray sources Reimbursable. |
| CS-A | Nov. | Delta | ETR | Provide communication coverage of Japan for both telephone and color TV transmission and experiments. Reimbursable. |
| OTS | Dec. | Delta | ETR | ESA experimental communications satellite. Reimbursable. |
| IUE-A | Dec. | Delta | ETR | International Ultraviolet Explorer-cooperative with ESA. Obtain high resolution data of stars and planets in the ultraviolet region of the spectrum. |
| Navy-20 | Dec. | Scout | WTR | Navy navigation satellite. Reimbursable (call-up). |

**Leaving for Final Destination**—After refurbishing for medical usage, the last remaining NASA Mobile Quarantine Facility leaves Houston aboard an Air Force plane for delivery to the Center for Disease Control in Atlanta. The trailer was used to house astronauts returning from the Moon during NASA's manned space flights.

*(from page 28)*

Dr. Lyle Conrad of the Atlanta center's epidemiology bureau said that the MQF contains all the medical supplies and apparatus needed for immediate use and that it can accommodate three patients for long-distance flights. He added that it is, in his opinion, the only vehicle durable enough for long-range transportation of afflicted individuals who require medical attention during flight. The MQF can be moved on four hours' notice by aircraft based in New Jersey, South Carolina or Illinois to distant destinations.

NASA's Dr. Wayland Hull of the JSC Life Sciences division coordinated the donation to the disease control center, and old-hand JSC technician Ed O'Briant assisted in the conversion work.

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### A Way of Forestalling Epidemics and Rescuing their Victims

Once upon a time, in the pioneering days of space exploration, genuine concern existed among world scientists over the possibility that travelers to the Moon could unwittingly bring back alien organisms that might threaten life on Earth.

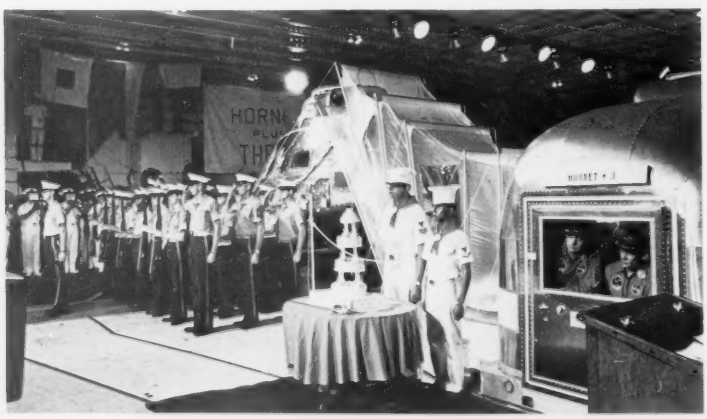
One of the precautions used to guard against such an event was the provision of temporary sterile quarters in which lunar astronauts could be isolated pending intensive examination of the men, their equipment and lunar samples. Now, nearly five years after the last Apollo flight, the one remaining "Mobile Quarantine Facility" has been donated by NASA to the U.S. Public Health Service's Center for Disease Control. Last November, the module was lifted by an Air Force C-141 aircraft from the Johnson Space Center to the Atlanta, Ga., disease control center.

The MQF became a familiar sight to millions of people throughout the world during the Apollo Moon missions as they watched astronauts touching down at sea, and being brought aboard ship and rushed into the self-contained trailer that became their temporary home until they arrived at the Johnson center's lunar receiving laboratory. The men were not released until scientists had determined that they were free of foreign contaminants. Four of the 12-meter-long, 11,000 kilogram (40-foot, 25,000-lb.) vehicles were on hand at the Johnson center from 1969 on.

In subsequent years, after the Moon flights had ended, NASA disposed of three of the trailers by giving two of them to the U.S. Department of Agriculture and one to the Smithsonian Institution. The fourth now stands ready in the Atlanta center to carry a victim of a dangerous exotic infection from an epidemic area anywhere in the world to a hospital capable of handling such an emergency situation.

The first emergency use for one of the modules by the disease center came in 1972, when one of its service officers was investigating an outbreak of the dread Lassa fever in Sierra Leone. On his way back to the U.S. from Africa, the doctor developed symptoms of the deadly virus infection. A NASA MQF was quickly provided for transport back to the U.S. and the doctor was isolated within the capsule until he could be delivered to the isolation ward of a hospital. (It was later ascertained that he had another disease less dangerous than Lassa fever.)

More recently, concerned over the possibility that medical investigators might become infected by another killer disease, the disease center called for the loan of the MQF for possible use during an epidemic of hemorrhagic fever that killed more than 300 people in the two African nations. Zaire and the Sudan. The threat fortunately has not yet become reality, but the loan became the gift and the trailer/module has been modified and medically equipped to cope with just such an emergency, and stands ready to do so. *(continued on page 27)*



**Soon After Apollo-11 Splashdown**—Almost eight years ago, the successful splashdown of the Apollo-11 astronauts was celebrated with an elaborate cake aboard the USS Hornet. Neil Armstrong (left) and Edwin E. Aldrin, Jr., can be seen looking through the window of the Mobile Quarantine Facility, the sterile trailer in which they were housed for sea and air travel to final destination at the Johnson Space Center in Houston.